CLAIMS

1. A pattern transfer method comprising the steps of:

performing processing for extracting feature points from image data obtained by photographing a substrate to be exposed, the substrate having been pretreated in a given manner;

performing processing for detecting amounts of deviations from comparison of results of said extraction of feature points and design pattern data to be exposed;

performing processing for modifying shapes of images in said design pattern data using results of said processing for detecting amounts of deviations;

causing an exposed image generator to produce the images obtained by results of said processing for modifying shapes of images as an exposure pattern; and

exposing said exposure pattern onto said substrate to be exposed.

2. A pattern transfer method as set forth in claim 1, wherein said design pattern data is any one of a printed wiring circuit pattern, a semiconductor circuit pattern, and a circuit pattern made of a combination thereof.

3. A pattern transfer method as set forth in claim 1, wherein in said pretreatment of the exposed substrate, there is the step of previously forming at least one layer of pattern in said design pattern data, and wherein a film of a photosensitive

material is subsequently applied to a top surface of said substrate to be exposed.

4. A pattern transfer method as set forth in claim 3, wherein in said pretreatment of the exposed substrate, at least four alignment patterns are formed in end portions of an effective area from which an image can be taken when light reflected from said substrate is photographed by said substrate image-taking imaging device, in addition to said design pattern.

5. A pattern transfer method as set forth in claim 4, wherein in said processing for extracting feature points, through-holes are used as the feature points, in addition to said alignment patterns.

6. A pattern transfer method as set forth in claim 4, wherein in said processing for extracting feature points, characteristic points at least around or inside a polygonal pattern or characteristic points on a straight or curved line are used as feature points, in addition to said alignment patterns.

7. A pattern transfer method as set forth in claim 1, wherein in said processing for detecting amounts of deviations, amounts of relative positional deviations are calculated for all feature points corresponding to both said image data and said design pattern data in a 1:1 relation.

8. A pattern transfer method as set forth in claim 7, wherein said processing for modifying shapes of images is carried

out by dividing areas by a triangular mesh having identical meshes for said image data and said design pattern data by the use of all the feature points corresponding in a 1:1 relation as described above as vertices and bringing the shapes of the triangles in the triangular mesh in said design pattern data into agreement with the shapes of the respective triangles in the triangular mesh in said image data.

9. A pattern transfer method as set forth in claim 8, wherein in said processing for modifying shapes of images, an affine transform is used.

10. A pattern transfer method as set forth in claim 1, wherein in a case where the position of said exposed substrate is controlled using an accurate positioning stage having a repetitive positioning accuracy of more than ± 11 nm (when length is taken as a unit), processing for controlling the position of the stage is performed from results of said processing for detecting amounts of deviations, a stage control signal in a given format is produced, and said accurate positioning stage is driven for physically moving said exposed substrate to thereby perform control in which the amount of relative positional deviation of at least one feature point corresponding in a 1:1 relation as described above is reduced to a minimum prior to pattern transfer.

11. A pattern transfer method as set forth in claim 1, wherein the material of said exposed substrate is a hard resin

material containing a main component that is paper-based phenol, glass composite, glass epoxy, diarylphthalate, epoxy resin, oxybenzoyl polyester, polyethylene terephthalate, polyimide, polymethyl methacrylate, polyoxymethylane, polyphenylene ether, polysulfone, or polytetrafluoroethylene.

12. A pattern transfer method as set forth in claim 11, wherein a single-crystal silicon region is present at least in a part of the exposed substrate made of said hard resin material.

13. A pattern transfer method as set forth in claim 1, wherein said exposed substrate is made of any one of silicon wafer, transparent glass material, and ceramics.

14. An exposure machine having means for holding a substrate to be exposed and for producing an arbitrary exposure pattern according to input of an image signal, the substrate having been pretreated in a given manner, said exposure machine having a pattern transfer system comprising:

optics for guiding light reflected from the exposed substrate into a substrate image-taking imaging device;

said substrate image-taking imaging device photographing the light reflected from the substrate via said optics and gaining the photographed light as image data;

an image signal creating device for creating said image signal;

a pattern transfer controller for receiving the image

data output from said substrate image-taking imaging device and outputting the image data to said image signal creating device; and

a design pattern data storage device having a function of transferring design pattern data to said pattern transfer controller;

wherein said pattern transfer controller has a function of performing processing for extracting feature points from the image data obtained from said substrate image-taking imaging device, performing processing for detecting amounts of deviations from results of said extraction of feature points and from said design pattern data, performing processing for modifying the shapes of images in said design pattern data using results of said processing for detecting amounts of deviations, and using the images obtained by results of said processing for modifying shapes of images as image data for said image signal creating device.

15. An exposure machine as set forth in claim 14, wherein said means for producing an arbitrary exposure pattern according to input of the image signal has a transmissive image display device.

16. An exposure machine as set forth in claim 15, wherein said substrate image-taking imaging device is placed in a position where light reflected from the substrate is photographed after passage through said transmissive image

display device.

17. An exposure machine as set forth in any one of claims 15 and 16, wherein said transmissive image display device is a transmissive liquid crystal display.

18. An exposure machine as set forth in claim 14, wherein said exposure machine adopts a reduction projection exposure system.

19. An exposure machine as set forth in claim 14, wherein said exposure machine adopts a proximity exposure system.

20. An exposure machine as set forth in claim 14, wherein said exposure machine adopts a magnified projection exposure system.

21. An exposure machine as set forth in claim 14, wherein there is provided an ultraaccurate positioning stage having a repetitive positioning accuracy of less than ± 11 nm (when length is taken as a unit) for a mechanism for controlling the position of said exposed substrate.

22. An exposure machine as set forth in claim 14, wherein there is provided an accurate positioning stage having a repetitive positioning accuracy of more than ± 11 nm (when length is taken as a unit) for a mechanism for controlling the position of said exposed substrate, the stage controlling the position of the exposed substrate according to a stage control signal transmitted from said pattern transfer controller.

23. An exposure machine as set forth in any one of claims 21 and 22, wherein said positioning stage has a non-resonant ultrasonic motor as a driving mechanism.